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NOTE ON THE POLAR OF A POINT AS TO A CONIC.

By GEORGE R. DEAN.

Let (x_1, y_1) be a point not on the curve, (x_2, y_2), (x_3, y_3) the intersections of a secant through (x_1, y_1) with the conic. The tangents at (x_2, y_2), (x_3, y_3) are

$$axx_2+h(x_2y+xy_2)+byy_2+2gx_2+2fy_2+c=0\ldots.(1),$$
$$axx_3+h(x_3y+xy_3)+byy_3+2gx_3+2fy_3+c=0\ldots.(2).$$

What line does the equation

$$axx_1+h(x_1y+xy_1)+byy_1+2gx_1+2fy_1+c=0\ldots.(3)$$

represent? Subtracting (2) from (1), (3) from (1), and (2) from (3), we find

$$(ax+hy+g)+(hx+by+f)\left(\frac{y_3-y_2}{x_3-x_2}\right)=0\ldots.(4),$$

$$(ax+hy+g)+(hx+by+f)\left(\frac{y_1-y_2}{x_1-x_2}\right)=0\ldots.(5),$$

$$(ax+hy+g)+(hx+by+f)\left(\frac{y_3-y_1}{x_3-x_1}\right)=0\ldots.(6).$$

Since (x_1, y_1), (x_2, y_2), (x_3, y_3) are collinear,

$$\frac{y_1-y_2}{x_1-x_2}=\frac{y_1-y_3}{x_1-x_3}=\frac{y_3-y_2}{x_3-x_2}=m, \text{ say.}$$

Therefore (4), (5) and (6) are identical. That is, the same straight line $(ax+hy+g)+(hx+by+f)m=0$ passes through all three vertices of a triangle, which can only happen when the three sides are concurrent. Hence (3) passes through the intersection of (1) and (2).

ROLLA, MO.